Exchange rate policy and trade balance: a cointegration analysis of the Argentine experience since 1962

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EXCHANGE RATE POLICY AND TRADE BALANCE. A COINTEGRATION ANALYSIS OF THE ARGENTINE EXPERIENCE SINCE 1962.

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Abstract: Using multivariate cointegration tests for non-stationary data and vector error correction models, this paper examines the determinants of trade balance for Argentina over the last forty to fifty years. Our investigation confirms the existence of long-run relationships among trade balance, Real Exchange Rate (RER) and foreign and domestic incomes for Argentina during different real exchange rate management policies. Based on the estimations, the Marshall-Lerner condition is examined and, by means of impulse response functions, we trace the effect of a one-time shock to the RER on the trade balance checking the J-curve pattern.

Keywords: Argentina, Marshall-Lerner, J-Curve, cointegration and impulse response analysis.

JEL Classification: C22, C32, F31, F43

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I. Introduction.

The management of the Exchange Rate has been a critical issue for the economic policy, especially in developing countries. In defining an exchange rate policy, one of the most important considerations is the responsiveness of Trade Balance (TB) to changes in terms of trade or, more generally, in Real Exchange Rate (RER). The effects of currency depreciation on a country's trade balance have centred an important and on-going debate in the international economic literature. Precisely, this issue has been traditionally studied in the Marshall-Lerner condition (ML) and the so called J-curve framework. According to the ML condition, currency devaluation improves the trade balance in the long run only if the sum of the absolute values of imports and exports demand price elasticities exceeds unit. However, due to the lag dynamics structure, TB can worsen in the short-run because of the inelastic demand for imports and exports in the immediate aftermath of an exchange rate change. In this case, TB is said to follow the J-curve pattern.

A wide number of papers has tested the ML condition and J-curve. Bahamani-Oskooee and Ratha (2004) is a good survey on ML and J-curve showing non conclusive results on this issue. In Bahamani-Oskooee and Niroomand (1998) the ML condition is addressed for almost thirty developed and developing countries over the period 1960-92. Gomes and Paz (2005) and Tsen (2006) demonstrate the existence of a long run relationship among TB, real exchange rate, foreign and domestic income for Brazil in the nineties and for Malaysia during 1965-2002 respectively. Mahmud et al. (2004) suggest that, though during fixed exchange rates periods ML condition is supported, it is less probable in flexible exchange periods. Almost all these papers find support for the existence of the J-curve pattern except Narayan (2004) who does not confirm the ML condition in New Zealand.

As far as we know, there is only one paper that deals with ML condition in Argentina, namely Lopez y Cruz (2000). This study supports the relationship among TB, real exchange rate, foreign and domestic income for the argentine economy during the period 1965-1995, but it does not analyse the short-run adjustment through the J-curve phenomenon. In this paper, we test not only the validity of ML condition but also the existence of a J-curve pattern for the argentine economy from 1962 up to nowadays discerning three cut-off points due to different periods of exchange and trade policies implemented in Argentina: 1990 reveals a clear change in argentine exchange rate regime when the Convertibility Plan in April 1991 fixed the Argentine peso to US dollar in a currency board system; 2000 evidences a slowdown triggering the sharp crises in 2002 and the end of the fixed exchange rate regime period after an intense devaluation of the currency in the first days of 2002. Finally, we have analysed 1978-05 period to capture relationships during the change in Argentina's trade policy making towards a liberalization phase, away from the import substitution protectionism period in 1978. We note that three of the periods we have tested, 1962-2005, 1962-2000 and 1978-05, include the Convertibility Plan stage which implied a fixed exchange rate policy with US dollar. The other one, 1962-1990, showed more flexible options on the currency.

Hence, the aim of the paper consists on empirically verify the ML condition and the J-curve pattern for Argentina. To this purpose, we exploit some econometric techniques using time series unit root tests to examine the stationary properties of the data and the Johansen and Juselius procedure (1991) to search for multivariate cointegrating relationships from a robust and stable vector autoregressive (VAR) modelling specification. Based on a vector error-correction (VECM) formulation and generalized impulse response function, we analyze the long and short term trade balance dynamic model for Argentina.

Taking into account the slow long run balance of payments constrained economic growth of Argentina suggested in several papers (see, for instance, López and Cruz (2000) and Perraton (2003) and the key role of the exchange rate rule on the Argentine development during the last decades, specially since 1991, we highlight the importance of this paper for policy–making decisions on exchange rate regime in the argentine economic development. The contributions of the paper are twofold. The first is to test ML and J-curve phenomenon for Argentina in different periods. The second is to provide new insights on the effects of fixed and flexible exchange rate regimes in the TB and, therefore, in the relationships between RER and long term economic growth.

The rest of the paper is organized as follows. Section 2 sets our model specification. In Section 3 we present the econometric methodology and our empirical results for Argentina. Finally, Section 4 concludes the paper.

II. Theoretical framework

Following the straightforward modelling introduced by Rose and Yellen (1989) and Rose (1991), a country's trade balance behaviour is built into a reduced form function directly depending on the real exchange rate and the real domestic and foreign incomes.

We begin with a standard model specification for export and import demand functions

$$X_t = \left(\frac{P}{P^* \cdot E} \right)_t^{\eta} \cdot \left(Y_t^* \right)^{\varepsilon} \qquad (1)$$

$$M_t = \left(\frac{P^* \cdot E}{P} \right)_t^{\gamma} \cdot \left(Y_t \right)^{\pi} \qquad (2)$$

where X and M are the volume of exports and imports, E is the nominal exchange rate and P, P^* and Y, Y^* denote the domestic and foreign price levels and incomes respectively; η and γ are the real exchange rate elasticities for exports and imports and ε and π are the income elasticities for imports and exports.

Using logarithms, equation (1) and (2) become

$$\ln X_t = \eta \left[\ln P_t - \ln P_t^* - \ln E_t \right] + \varepsilon \ln Y_t^* \qquad (3)$$

$$\ln M_t = \gamma \left[\ln P_t^* + \ln E_t - \ln P_t \right] + \pi \ln Y_t \qquad (4)$$

where $\ln e_t = \left[\ln P_t^* + \ln E_t - \ln P_t \right]$ is the natural logarithm of real exchange rate. Let TB stand for the trade balance. Following common practice, TB is defined as the ratio between exports and imports so

$$\ln TB_t = \pi \ln Y_t + \varepsilon \ln Y_t^* + \vartheta \ln e_t \qquad (5)$$

where $\vartheta = -(\eta + \gamma)$. Precisely, the coefficient of $\ln e_t$ indicates whether the ML condition is fulfilled. Note that here η and γ are assumed to be negative and ε and π are positive so ML holds whenever ϑ is positive indicating that a higher real exchange rate, that is, a real depreciation, appears to improve the trade balance over time.

Our major concern is focused on the time-path dynamics of the trade balance analyzing both the long run and short term impact of changes in the exchange rate of the Argentina's currency checking, in selected periods over the sample 1962-2005, whether it induced an upgrading or a worsening of the country's trade position.

III. Methodology, empirical results and discussion.

In this section we present the estimation techniques as well as the empirical results testing not only the long- and short-terms impacts of real exchange rate on the trade balance but also the validity of the ML condition for Argentina. In this fashion, we firstly examine whether there exists a long-run relationship between trade balance and real exchange rate, foreign income and domestic income for Argentina. Second, we test if a worsening of the RER results in a long-term improvement in the trade balance. Finally, we apply the impulse response analysis to determine whether shocks to RER induce the trade balance to follow a J-Curve.

Annual data from the International Financial Statistics published by the International Monetary Fund (IMF) are used in our analysis covering the whole period 1962-2005. National (Y) and foreign income (Y^*) are defined by GDP volume index numbers and the US GDP is taken as the proxy for world output. TB is constructed as the rate volume of exports and volume of imports and the real exchange rate (RER) is computed as the ratio of foreign price proxied by US consumer price to domestic consumer price multiplied by the nominal exchange rate of the domestic currency with US dollar. All the variables are expressed in logarithmic forms.

In keeping with the trade balance evolution encapsulated in equation (5), we assume that the long-run cointegrating testable relationship takes the following log-linear form

$$\ln TB_t = \beta_o + \beta_1 \ln Y_t + \beta_2 \ln Y_t^* + \beta_3 \ln RER_t + u_t \qquad (6)$$

where u_t is the random error term. In this regard, likelihood-based inference in cointegrating vector autoregressive models is required in order to determine whether this linear combination of non-stationary data series of TB, real exchange rate and foreign and domestic incomes is stationary and, therefore, describes a stable and non-spurious regression.

In so doing, we run univariate Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) unit root tests for each variable that enters the multivariate model following the decision tree process proposed by Charemza and Deadman (1992) testing for the significance of trend and drift together with non-stationary and assuming that the choice of lags is based to guarantee non-residual autocorrelation. The results over the period 1962-2005 are reported in table (1) and indicate that $\ln Y$ and $\ln Y^*$ and $\ln RER$ contain a unit root in their levels form but not in their first differences form so they are integrated of order one, I(1), while $\ln TB$ is also stationary in levels. In addition, we find that neither trends nor drifts should be entered in the cointegration space. Though not reported here, we have checked that all the variables are I(1) series for each of the short time spans considered. Note that, if the series have not contain a unit root, the cointegration test will lead to a number of cointegration vectors equal to four which is the number of endogenous variables.

Turning to cointegration analysis, we implement the cointegration test developed by Johansen (1988) and Johansen and Juselius (1990) which applies maximum likelihood to a VAR model assuming that the errors are Gaussian. Essentially, testing the existence of this long-run relationship requires a pth-order structural and dynamic VAR model on the variables under consideration which, in keeping with Granger representation theorem, can be written as an unrestricted VEC involving up to p lags

$$\Delta \ln TB_t = \delta_0 + \sum_{j=1}^{p} \theta_k \Delta \ln TB_{t-j} + \sum_{j=1}^{p} \gamma_k \Delta \ln Y_{t-j} + \sum_{j=1}^{p} \varphi_k \Delta \ln Y^*_{t-j} + \sum_{j=1}^{p} \phi_k \Delta \ln RER_{t-j} +$$

$$+ \lambda\left[\ln TB_{t-1} - \beta_o - \beta_1 \ln Y_{t-1} - \beta_2 \ln Y^*_{t-1} - \beta_3 \ln RER_{t-1}\right] + \varepsilon_t \qquad (7)$$

where Δ is the first difference operator, λ provides information on the speed-of-adjustment coefficient to long-run equilibrium and ε_t is a purely white noise term.

To this purpose, we firstly proceed by setting the appropriate lag-length in order to ensure the gaussian structure of the residuals in the VECM. We note that when the errors are not independent normal, it has been found that the Johansen method has a greater probability of rejecting the null of non cointegration even when there are no cointegrationg relations. In this fashion, we have selected the number of lags indicated by Schwartz (BIC) and Hannah-Quinn (HQ) criteria in all stages except for the term 1978-2005 where lags were chosen on the basis of the Akaike (AIC) criterion which has provided better results for Gaussian errors. On the basis of these information criteria, the best lag order is one year for the longer periods, 1962-2005 and 1962-2000, and two years for the shorter ones, 1978-2005 and 1962-1990. For brevity the results are not reported here. Following the Box and Jenkins (1970) approach, the diagnostic checking listed in table (2) deals with residual Portmanteau (Q) and Breusch-Godfrey Lagrange Multiplier (LM) autocorrelation tests, White heterocedasticity and Jarque-Bera residual normality test via Cholesky (JB_{CHOL}) and Urzua (JB_{URZ}) factorizations and leads to well-behaved residuals in all periods.

Next, we apply Johansen and Juselius (1990) procedure testing for number and estimations of cointegrating relations. Let r be set from zero to $k-1$, where $k=4$ is the number of endogenous variables in our modeling. The procedure leads to two statistics for cointegration: the *trace statistic*, λ_{trace}, tests the hypothesis that there are at most r cointegrating vectors while the *maximal-eigenvalue statistic*, $\lambda_{\max}$, tests that there are r cointegrating vectors against the alternative that $r+1$ exists. The results of this sequential testing performance are reported in table (4) for every sample. We remark that the non-standard critical values are taken from Osterwald-Lenum (1992) which differ slightly from those reported in Johansen and Juselius (1990). Both statistics [1] confirm the existence of at most one cointegrating equilibrium relationship among the logarithms of TB, national and foreign income and real exchange rate at the 5% level.

Table (4) summarizes the estimated cointegrating vectors normalized on trade balance and the adjustment parameters, λ. Each cointegrating coefficient, b_1, b_2 and b_3, measures the trade balance elasticity with respect to the argentine income, the US income and the RER respectively, that is, the percentage change in TB for one unit percentage change in each of the explanatory variables. As expected, in all cases trade balance is negatively associated with domestic output and positively associated with international output. However, except for the sub-sample 1962-1990, in all periods trade balance and real exchange rate are found to be positively cointegrated and the elasticity coefficient b_3 is positive and statistically significant at the 95% confidence level.

These results hint us to conclude that, in these terms, the Marshall-Lerner condition is fulfilled and an increase in the real exchange rate has not only influenced but also has improved the Argentinean trade balance. Interestingly, ML condition only holds when the fix exchange rate period during Convertibility Plan in the nineties is included (observe that only in 2002 the fix parity dollar-peso was abandoned and ML holds in all periods counting the Convertibility Plan[2]) and, on the contrary, it is not fulfilled in previous periods when the exchange rate policy has shown more flexible systems. In this sense, these results are aligned with those of Mahmud, et al. (2004) for developed countries and of Gomes and Paz (2005) for Brazil during Real crawling-peg exchange

[1] Johansen and Juselius (1990) suggest that, in case that the statistics yield conflicting results, the maximum eigenvalue test may be better.
[2] In fact, we have tested different periods and ML condition begins to be fulfilled after 1994.

rate regime system in the nineties. As occurred in Brazil, real exchange rate in Argentina was supposed to be appreciated during the Convertibility Plan.

Moreover, in table (4), we can observe that when ML condition holds, the foreign and domestic income coefficients, b_1 and b_2, are not statistically significant at the 5% level. However, in the 1962-90 period, when ML rule is not verified, income coefficients are significant indicating that during not fixed exchange rate periods, TB is more influenced by foreign and domestic income and therefore by foreign and domestic output growth rythms. From our point of view, these results are suggesting that currency devaluation in 2002 was necessary to improve the TB and recover an economic growth path more consistent with the balance of payments constraint that Argentine economy seems to bear in the long run (López and Cruz (2000) and Perraton (2003). Finally, we note that the significance of the parameter λ in all samples indicates that trade balance changes does not even up changes in past disequilibrium of either national and foreign income or real exchange rate during the same period.

We have checked that in all periods the estimated VEC models with one cointegrating relations are stable[3] and that the innovations are contemporaneously uncorrelated. This enables us to analyze the J-curve phenomenon for Argentina by taking into account the dynamic lag structure of the VEC formulation. A one time shock to the real exchange rate is traced and the generalized impulse response function of $\ln TB$ are obtained for Cholesky one standard-deviation $\ln RER$ innovations. The results over the hold period are represented in figure 1 and suggest that for Argentina we do not find a negative effect of devaluation on the trade balance and the most important improvements on the TB have around four to five years of duration. However, for the period 1962-1990, Figure 2 shows that the effect is negative firstly from the fourth to the sixth year and again from the ninth to the eleventh year. We note that is precisely the unique sample where it is not verified the Marshall-Lerner condition. Hence, with the exception of the sub-period before the Convertibility Plan, no evidence in favour of the J-curve short term TB adjustment was found for Argentina, by using annual data.

[3] The stability of the estimated VAR and VEC has been checked in each of the sub-periods from the inverse kp roots of the characteristic AR polynomial, where k is the number of endogenous variables and p is the largest one. The stability condition is verified if all the roots have modulus less than one. In a VEC estimation with r cointegration relations this implies that kr roots should be equal to unity,

IV. Conclusions and policy implications.

In this paper we assess the long and short run effects of real exchange rate on the Argentinean TB in a long period beginning in 1962. By using VAR-based cointegration tests and impulse response functions, we show that ML condition is fulfilled in the periods including fix exchange rate regime policy but not in those periods when exchange rate has shown more flexible policies. This result coincides with those reported by Mahmud et al. (2004) for developed countries. In the short run, Argentine TB has not usually followed the J-curve pattern of adjustment. Only before the Convertibility Plan launching in 1991, the impact of TCR is negative on the long-term and short-run TB showing that though the ML condition does not hold a J-curve-type phenomenon is observed.

A policy-making implication of our results suggests that, likely, currency devaluation in 2002 (and, therefore, the abandon of the currency board implemented in the Convertibility Plan) was necessary for improving TB and recovering a more sustainable economic growth path. In this sense, flexible exchange rate policies seems to be necessary to induce a balance of payments long run sustainability and, therefore, for argentine economic development.

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APPENDIX

Table 1 . Augmented Dickey-Fuller test (ADF). Argentina 1962-2005.

$$H_0 : \delta = 0$$
$$H_1 : \delta < 0$$

$$\text{(i)}\ \Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{i=1}^{m} (\alpha_i \Delta y_{t-i}) + \varepsilon_t$$

$$\text{(ii)}\ \Delta y_t = \beta_1 + \delta y_{t-1} + \sum_{i=1}^{m} (\alpha_i \Delta y_{t-i}) + \varepsilon_t$$

$$\text{(iii)}\ \Delta y_t = \delta y_{t-1} + \sum_{i=1}^{m} (\alpha_i \Delta y_{t-i}) + \varepsilon_t$$

variable	k	Model (i) Φ_3	Model (i) t_{tc}	Model (ii) Φ_1	Model (ii) t_c	Model (iii) t_{nc}
$\ln TB$	0	0.171	-3.428	2.128	-3.49	-2.697***
$\Delta \ln TB$	0	n.a.	n.a	n.a	n.a.	-5.889***
$\ln Y$	1	2.079	- 2.355	1.2366	-1.101	2.039
$\Delta \ln Y$	1	n.a.	n.a	n.a	n.a.	-4.069*
$\ln Y*$	0	3.59	-3.729	2.767	-1.662	10.256
$\Delta \ln Y^*$	0	n.a.	n.a	n.a	n.a.	-2.144*
$\ln RER$	0	-0.094	-2.791	2.007	-2.851	-1.960
$\Delta \ln RER$	0	n.a.	n.a	n.a	n.a.	-6.875* **

Notes: *k is the* lag structure order chosen to guarantee white noise residuals and Δ is the first differenced lag operator*;* subscripts *tc*, *c* and *nc* indicate if trend and intercept, intercept or none is included in test equation (iii), (ii) and (i). Φ_3, $\tau_{\beta\delta}$, Φ_1, $\tau_{\alpha\mu}$ denote statistics for individual or joint significance of trend and intercept assuming unit root. * and ** show 5% and 1% significance level in accordance to MacKinnon critical values; n.a is non available. Results implemented using Eviews 4.1.

Table 2. VAR. Lags structure and residuals

Period	Lag structure		Residuals-Diagnostic Views				
			Ho: non autocorrelation		Ho: normality		Ho: homocedasticity
	Lag order	Stability	Q	LM	JB_{Chol}	JB_{Urz}	White
1962-2005	1	yes	215.25	13.51	9.07	62.78	89.95
1962-2000	1	yes	185.77	11.82	7.91	61.14	88.13
1978-2005	2	yes	102.12	11.59	12.34	33.51	164.36
1962-1990	2	yes	93.76	9.16	10.62	41.66	170.83

Notes:
Lags for autocorrelation tests are taken as the third part of the observations . Results carried out by Eviews 4.1

Table 3. Johansen and Juselius Cointegration Test

Period	Lags	Number of cointegration relations under Ho	Johansen Test: Statistics λ_{trace}	CV(5%)	λ_{max}	CV(5%)
1962-2005	1	r=0	49.38*	47.21	32.04*	27.07
		r=1	17.34	29.68	10.38	20.97
		r=2	6.95	15.41	6.84	14.07
		r=3	0.12	3.76	0.12	3.76
1962-2000	1	r=0	55.12*	47.21	32.23*	27,07
		r=1	22.88	29.68	14.89	20.97
		r=2	7.98	15.41	7.89	14.07
		r=3	0.09	3.76	0.09	3.76
1978-2005	2	r=0	63.22**	47.21	33.32**	27.07
		r=1	29.91*	29.68	16.43	20.97
		r=2	13.47	15.41	12.81	14.07
		r=3	0.66	3.76	0.66	3.76
1962-1990	2	r=0	85.71**	47.21	56.52**	27.07
		r=1	29.19	29.68	16.26	20.97
		r=2	12.92	15.41	12.89	14.07
		r=3	0.03	3.76	0.03	3.76

Notes: Lag structure is drawn in each period from Table 3 results. *(**) denotes rejection of the hypothesis at the 5%(1%) level taking into account Osterwald-Lenum critical values. Trace and Max-eigenvalue test indicates 1 cointegrating equation(s) both 5% level levels.Results computed with Eviews 4.1

Table 4 . Johansen. Estimated cointegrating equation

Period	Cointegrating coefficients b_0	b_1	b_2	b_3	ECM λ
1962-2005	0.1591	-0.3395	0.3339	0.6095	- 0.8837
		[0.8281]	[-1.362]	[-5.51]	[-4.483]
1962-2000	1.423	- 0.6121	0.3295	0.3887	-0.692
		[1.541]	[-1.323]	[-3.336]	[-3.98]
1978-2005	0.0128	-0.115	0.124	0.8231	-1.943
		[0.323]	[-0.769]	[-10.887]	[-3.683]
1962-1990	-0.512	- 0.8296	1.1224	- 0.0283	-3.022
		[9.454]	[-15.149]	[0.863]	[-7.956]

Notes: The vectors are normalized for TB; b_1 , b_2 and b_3 denote the argentine GDP, USA GDP and TCR elasticties of trade balance, respectively. Figures in parentheses represent asymptotic *p*-values associated with the tests. Results carried out by Eviews 4.1.

Figure 1.

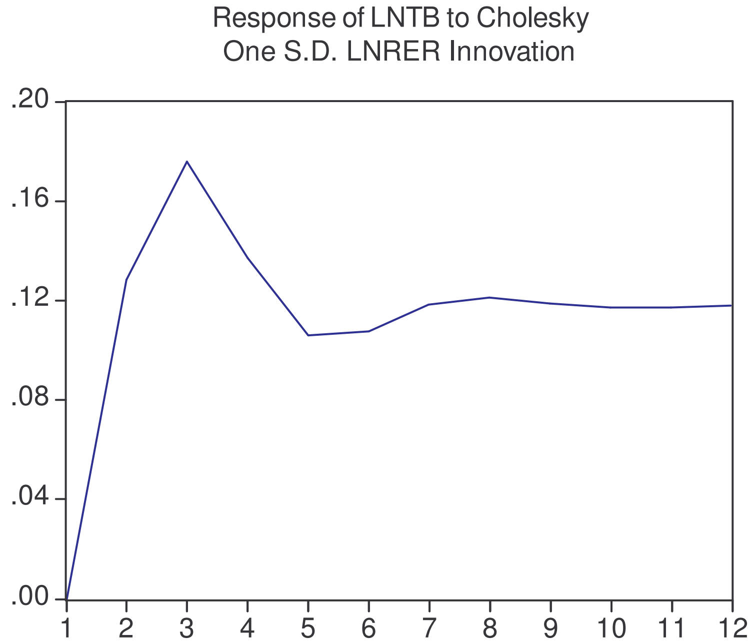
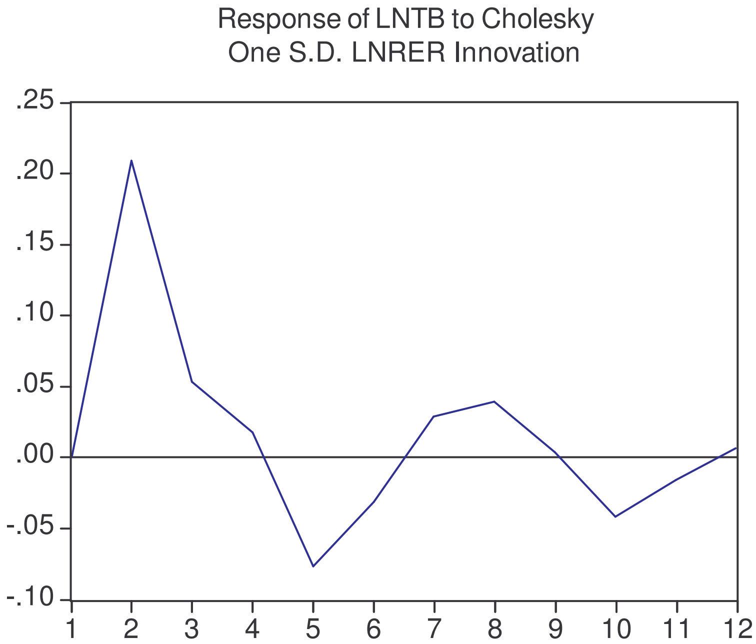


Figure 2.



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Abstract: Using multivariate cointegration tests for non-stationary data and vector error correction models, this paper examines the determinants of trade balance for Argentina over the last forty to fifty years taking into account that the short-run impacts of currency depreciation on the trade balance behaviour may differ from the long-run effects. Our investigation confirms the existence of long-run relationships among trade balance, real exchange rate and foreign and domestic incomes for Argentina during different real exchange rate management policies. Based on the estimations, the Marshall-Lerner condition is checked and, by means of impulse response functions, we trace the effect of a one-time shock to the real exchange rate on the trade balance not finding support for a J-curve pattern in the short-run.

Keywords: Argentina, Marshall-Lerner, J-Curve, cointegration, impulse response analysis and variance decomposition.

JEL Classification: C22, C32, F31, F43

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I. Introduction

The management of the exchange rate has been a critical issue for the economic policy, especially in developing countries. In defining an exchange rate policy, one of the most important considerations is the responsiveness of Trade Balance (TB) to changes in terms of trade or, more generally, in Real Exchange Rate (RER). The effects of currency depreciation on a country's trade balance have centred an important and on-going debate in the international economic literature. Precisely, this issue has been traditionally studied in the Marshall-Lerner condition (ML) and the so called J-curve framework. According to the ML condition, currency devaluation improves the trade balance in the long-run only if the sum of the absolute values of imports and exports demand price elasticities exceeds unit. However, due to the lag dynamics structure, TB can worsen in the short-run because of the inelastic demand for imports and exports in the immediate aftermath of an exchange rate change. In this case, TB is said to follow the J-curve pattern. Precisely, both the short and the long-run relationships are considered the underlying model that policy makers use in formulating exchange rate policies.

A wide number of papers have tested the ML condition and J-curve for developed and developing countries. There are two strands of the empirical literature on the issue depending on whether aggregate or bilateral trade information is used. On one hand, those works testing ML condition and J-curve pattern that have used country exports and imports aggregate data to assess the impact of currency depreciation on the trade balance. Among this string of works, without searching for an exhaustive review, we could cite using similar econometric methods: Demirden and Pastine (1995) support the existence of the J-Curve for the US in the flexible exchange rate period after the collapse of Breton Wood system and so, indirectly, fulfilled the ML condition. In the same direction, the results by Gupta-Kapoor and Ramakrishnan (1999) support J-Curve for Japan during 1975-1996. In Bahamani-Oskooee and Niroomand (1998) the ML condition is addressed for almost thirty developed and developing countries over the period 1960-92. Lal and Lowinger (2002) found evidences of J-curve patterns for seven Asian developing countries from 1980 to 1998. Gomes and Paz (2005) and Tsen (2006) demonstrate the existence of a long-run relationship among TB, real exchange rate, foreign and domestic income for Brazil in the nineties and for Malaysia during 1965-2002 respectively. Mahmud et al. (2004) suggest that, though during fixed exchange rates periods ML condition is supported, it is less probable in flexible exchange periods. Narayan (2004) does not confirm the ML condition in New Zealand. On the other hand, there are studies that assessed the impact of currency depreciation of a country on their most important bilateral trade flows partners. For instance, in Nadenichek (2006) bilateral trade flows among US and the other G7 countries are found to follow a J-curve pattern in the long period 1974-2004. On the contrary, Bahmani-Oskooee and Wang (2006) has found little evidence of J-curve hypothesis in China with their 13 major trade partners. Bahmani-Oskooee and Harvey (2006) results reveal short-run effects on Malaysian bilateral trade flows with most of their 14 major commercial partners but these effects do not hold on the long-run. Bahmani-Oskooee et al. (2006) find mixed effects on the J-curve phenomenon and ML condition among the United Kingdom and their twenty major partners. Narayan (2006) finds evidence of ML condition between China and its trade flows with US but does not confirm the J-curve pattern. Finally, Bahamani-Oskooee and Ratha (2004) is a good survey on ML and J-curve showing non conclusive results on this issue.

As far as we know, there is only one paper that deals with ML condition in Argentina, namely Lopez y Cruz (2000). This study supports the relationship among TB, real exchange rate, foreign and domestic income for the Argentine economy during the period 1965-1995, but it does not analyse the short-run adjustment through the J-curve phenomenon. In this paper, we test not only the validity of ML condition but also the existence of a J-curve pattern for the Argentine economy from 1962 up to nowadays discerning three cut-off points accordingly to different periods of exchange and trade policies implemented in Argentina: 1990 reveals a clear change in Argentine exchange rate regime when the Convertibility Plan in April 1991 fixed the Argentine peso to US dollar in a currency board system; 2000 evidences a slowdown triggering the sharp crises in 2002 and the end of the fixed exchange rate regime period after an intense devaluation of the currency in the first days of 2002. Finally, we have analysed the 1978-05 period to capture relationships during the change in Argentina's trade policy making towards a liberalization phase, away from the import substitution protectionism period in 1978. We note that three of the periods we have tested -1962-2005, 1962-2000 and 1978-05- include the Convertibility Plan stage which implied a fixed exchange rate policy with US dollar. The other one, 1962-1990, showed more flexible options on the currency.

Our major concern in this paper is to empirically estimate the all-out dynamic of the trade balance in relation to the exchange rate in addition to other income variables by discerning the long-run effects of currency depreciation on the trade balance for Argentina from its short-run impacts. To this purpose, we exploit some econometric techniques using time series unit root tests to examine the stationary properties of the data and the Johansen and Juselius procedure (1991) to search for multivariate cointegrating relationships from a robust and stable vector autoregressive (VAR) modelling specification. Based on a vector error-correction (VEC) formulation and generalized impulse response function, we analyze the long and short term trade balance dynamic model for Argentina. To conclude, and in order to identified the determinants of the trade balance, we run a variance decomposition analysis examining how much percentage of the total forecast error variance of the TB is explained by each component.

Taking into account the slow long-run balance of payments constrained economic growth of Argentina suggested in several papers (see, for instance, López and Cruz (2000) and Perraton (2003) and the key role of the exchange rate rule on the Argentine development during the last decades, specially since 1991, we highlight the importance of this paper for policy–making decisions on exchange rate regime in the argentine economic development. The contributions of the paper are twofold. The first is to test ML and J-curve phenomenon for Argentina in different periods. The second is to provide new insights on the effects of fixed and flexible exchange rate regimes in the TB and, therefore, in the relationships between RER and long term economic growth. In particular, we address that, under the regime of managed float, foreign income has also been a crucial factor in the trade balance dynamics and, therefore, its variability should not be mainly attributed to real exchange shocks, as we demonstrate that it has occurred in those periods running over the fix-rate policy-making

The rest of the paper is organized as follows. Section 2 sets our model specification. In Section 3 we present the econometric methodology and our empirical results for Argentina. Finally, Section 4 concludes the paper.

II. Theoretical framework

Following the straightforward modelling introduced by Rose and Yellen (1989) and Rose (1991), a country's trade balance behaviour is built into a reduced form function directly depending on the real exchange rate and the real domestic and foreign incomes.

We begin with a standard model specification for export and import demand functions

$$X_t = \left(\frac{P}{P^* \cdot E}\right)_t^{\eta} \cdot \left(Y_t^*\right)^{\varepsilon} \qquad (1)$$

$$M_t = \left(\frac{P^* \cdot E}{P} \right)_t^{\gamma} \cdot (Y_t)^{\pi} \qquad (2)$$

where X and M are the volume of exports and imports, E is the nominal exchange rate and P, P^* and Y, Y^* denote the domestic and foreign price levels and incomes respectively; η and γ are the real exchange rate elasticities for exports and imports and ε and π are the income elasticities for imports and exports.

Using logarithms, equation (1) and (2) become

$$\ln X_t = \eta[\ln P_t - \ln P_t^* - \ln E_t] + \varepsilon \ln Y_t^* \qquad (3)$$

$$\ln M_t = \gamma[\ln P_t^* + \ln E_t - \ln P_t] + \pi \ln Y_t \qquad (4)$$

where $\ln e_t = [\ln P_t^* + \ln E_t - \ln P_t]$ is the natural logarithm of real exchange rate. Let TB stand for the trade balance. Following common practice, TB is defined as the ratio between exports and imports so

$$\ln TB_t = \pi \ln Y_t + \varepsilon \ln Y_t^* + \vartheta \ln e_t \qquad (5)$$

where $\vartheta = -(\eta + \gamma)$. Precisely, the coefficient of $\ln e_t$ indicates whether the ML condition is fulfilled. Note that here η and γ are assumed to be negative and ε and π are positive so ML holds whenever ϑ is positive indicating that a higher real exchange rate, that is, a real depreciation, appears to improve the trade balance over time.

Our major concern is focused on the time-path performance of the trade balance analyzing both the long-run and short term impact of changes in the exchange rate of the Argentina's currency checking, whether it induced an upgrading or a worsening of the country's trade position.

III. Methodology, empirical results and discussion.

In this section we present the estimation techniques as well as the empirical results on the dynamics of trade balance for Argentina in selected sub-periods over the whole sample 1962-2005. Taking into account its interrelation with real exchange rate, the dynamic specification of the trade balance is assumed to be related to the lagged values of real exchange rate in addition to other income variables. As long as we are interested in examining the long-run as well as the short run effects of real depreciations, an error correction model is estimated.

In this fashion, we firstly examine whether there exists a long-run relationship between trade balance and real exchange rate, foreign income and domestic income for Argentina. Secondly, we test if a worsening of the RER results in a long term improvement in the trade balance. Thirdly, we apply the impulse response analysis to determine whether shocks to RER induce the trade balance to follow a J-Curve. Finally, a variance decomposition allows us to quantify the influence of real exchange rate shocks on the trade balance variability.

Annual data from the International Financial Statistics published by the International Monetary Fund (IMF) are used in our analysis covering the whole period 1962-2005. National (Y) and foreign income (Y^*) are defined by gross domestic product (GDP) volume index numbers and the US GDP is taken as the proxy for foreign output[2]. TB is constructed as the rate volume of exports and volume of imports and the real exchange rate is computed as the ratio of foreign price proxied by US consumer price to domestic consumer price multiplied by the nominal exchange rate of the domestic currency with US dollar. All the variables are expressed in logarithmic forms.

In keeping with the trade balance evolution encapsulated in equation (5), we assume that the long-run cointegrating testable relationship takes the following log-linear form

$$\ln TB_t = \beta_o + \beta_1 \ln Y_t + \beta_2 \ln Y_t^* + \beta_3 \ln RER_t + u_t \qquad (6)$$

where u_t is the random error term. We note that it is expected that an estimate of β_1 will be positive as long as an increase in the Argentine income usually results in a higher demand for imports. By the same token, a raise in foreign growth uses to induce an increase in the exports demand so a negative estimate of β_2 is awaited. Depending on whether a higher RER improves or deteriorates the trade balance, the coefficient of β_3 will be positive or negative respectively.

[2] Despite the USA has been the major trading partner for Argentina in the analysed period (for instance, in 1980 USA represent 31% of Argentinian exports and imports, in 2000 this percentage was 30,5%, only Brazil, during the nineties has been more important in the Argentinian trade balance), we have extended the same analysis by considering as "foreign income" the World GDP volume index from the data statistics provided by The World Bank. The long and the short-run analysis yield estimations which are lining up with these ones reported in this paper. These estimations can be obtained from the authors.

In this regard, likelihood-based inference in cointegrating vector autoregressive models is required in order to determine whether this linear combination of non-stationary data series of TB, real exchange rate and foreign and domestic incomes is stationary and, therefore, describes an equilibrium and non-spurious regression.

In so doing, we run univariate Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) unit root tests for each variable that enters the multivariate model following the decision tree process proposed by Charemza and Deadman (1992) testing for the significance of trend and drift together with non-stationary and assuming that the choice of lags is based to guarantee non-residual autocorrelation. The results over the period 1962-2005 are reported in Table (1) and indicate that $\ln Y$, $\ln Y^*$ and $\ln RER$ contain a unit root in their levels form but not in their first differences form so they are integrated of order one, I(1), while $\ln TB$ is also stationary in levels[3]. In addition, we find that neither trends nor drifts should be entered in the cointegration space. Though not reported here, we have checked that all the variables are I(1) series for each of the short time spans considered. Note that, if the series have not contain a unit root, the cointegration test will lead to a number of cointegration vectors equal to four which is the number of endogenous variables.

Turning to cointegration analysis, we implement the cointegration test developed by Johansen (1988) and Johansen and Juselius (1990) which applies maximum likelihood to a VAR model assuming that the errors are Gaussian. Essentially, testing the existence of this long-run relationship requires a pth-order structural and dynamic VAR model on the variables under consideration which, in keeping with Granger representation theorem, can be written as an unrestricted VEC involving up to p lags

$$\Delta \ln TB_t = \delta_0 + \sum_{j=1}^{p} \theta_j \Delta \ln TB_{t-j} + \sum_{j=1}^{p} \gamma_j \Delta \ln Y_{t-j} + \sum_{j=1}^{p} \varphi_j \Delta \ln Y^*_{t-j} + \sum_{j=1}^{p} \phi_j \Delta \ln RER_{t-j} +$$

$$+ \lambda \left[\ln TB_{t-1} - \beta_o - \beta_1 \ln Y_{t-1} - \beta_2 \ln Y^*_{t-1} - \beta_3 \ln RER_{t-1} \right] + \varepsilon_t \qquad (7)$$

[3] The computed test statistics for the unit root null are greater than the MacKinnon (1996) critical values though at the 1 percent level the ADF test yields really close to the corresponding tabulated value. The ADF result coincides with the usual persistence of the variable and, therefore, the stationary consideration of the TB followed in the related literature. See Nadenichek (2006) and Kim (1996) not only for a clear and brief discussion but also for examples on the stationary treatment of the trade balance.

where Δ is the first difference operator, λ provides information on the speed-of-adjustment coefficient to long-run equilibrium and ε_t is a purely white noise term.

We remark that having estimating the cointegrating relationship (6), which yield the long-run elasticity parameters, the error correction modelling defined by equation (7) reflects the short-run dynamic behaviour model of the TB using the estimates of past disequilibrium.

To this purpose, we firstly proceed by setting the appropriate lag-length in order to ensure the gaussian structure of the residuals in the VECM. We note that when the errors are not independently normal, it has been found that the Johansen method has a greater probability of rejecting the null of non cointegration even when there are no cointegrationg relations. In this fashion, we have selected the number of lags indicated by Schwartz (BIC) and Hannah-Quinn (HQ) criteria in all samples except for the term 1978-2005 where lags were chosen on the basis of the Akaike (AIC) criterion which has provided better results for Gaussian errors. On the basis of these information criteria, the best lag order is one year for the longer periods, 1962-2005 and 1962-2000, and two years for the shorter ones, 1978-2005 and 1962-1990. For brevity the results are not reported here. Following the Box and Jenkins (1970) approach, the diagnostic checking listed in Table (2) deals with residual Portmanteau (Q) and Breusch-Godfrey Lagrange Multiplier (LM) autocorrelation tests, White heterocedasticity and Jarque-Bera residual normality test via Cholesky (JB_{CHOL}) and Urzua (JB_{URZ}) factorizations and leads to well-behaved residuals in all periods.

Next, we apply Johansen and Juselius (1990) procedure testing for number and estimations of cointegrating relations. Let r be set from zero to $k-1$, where $k=4$ is the number of endogenous variables in our modelling. The procedure, which allows for interrelation effects among a set of variables, leads to two statistics for cointegration: the *trace statistic*, λ_{trace}, tests the hypothesis that there are at most r cointegrating vectors while the *maximal-eigenvalue statistic*, $\lambda_{\max}$, tests that there are r cointegrating vectors against the alternative that $r+1$ exists. The results of this sequential testing performance are reported in Table (3) for every sample. We remark that the non-standard critical values are taken from Osterwald-Lenum (1992) which differ slightly from those reported in Johansen and Juselius (1990). The null hypothesis of non cointegration ($r=0$) among all the variables that enter into the trade balance equation (6) can be rejected by the trace test and the $\lambda_{\max}$ test in each of the considered samples. Both statistics [4] confirm the existence of at most one cointegrating equilibrium relationship among the logarithms of TB, national and foreign income and real exchange rate at the 5% level of significance.

Table (4) summarizes the estimated cointegrating vectors normalized on trade balance and the adjustment parameters, λ. By setting the estimated coefficient of $\ln TB$ at -1 we normalize the income and RER coefficients and, therefore, the estimates of $\beta_1 - \beta_3$ indicate the long-run trade balance elasticities. Hence, each cointegrating parameter, b_1, b_2 and b_3, measures the trade balance elasticity with respect to the Argentine income, the US income and the RER respectively, that is, the percentage change in TB for one unit percentage change in each of the explanatory variables. As expected, in all cases trade balance is negatively associated with domestic output and positively associated with international output. However, except for the sub-sample 1962-1990, in all periods trade balance and real exchange rate are found to be positively cointegrated and the elasticity coefficient b_3 is positive and statistically significant at the 95% confidence level.

These results hint us to conclude that, in these terms, the Marshall-Lerner condition is fulfilled. Hence, the long-run approach to estimate the ML condition reveals that an increase in the real exchange rate has not only influenced but also has improved the Argentinean trade balance. Interestingly, ML condition only holds when the fix exchange rate period during Convertibility Plan in the nineties is included (observe that only in 2002 the fix parity dollar-peso was abandoned and ML holds in all periods counting the Convertibility Plan[5]) and, on the contrary, it is not fulfilled in previous periods when the exchange rate policy has shown more flexible systems. In this sense, these results are aligned with those of Mahmud, et al. (2004) for developed countries and of Gomes and Paz (2005) for Brazil during Real crawling-peg exchange rate regime system in the nineties. As occurred in Brazil, real exchange rate in Argentina was supposed to be appreciated during the Convertibility Plan.

Moreover, in Table (4), we can observe that when ML condition holds, the foreign and domestic income coefficients, b_1 and b_2, are not statistically significant at the 5% level. However, in the 1962-90 period, when ML rule is not verified, income

[4] Johansen and Juselius (1990) suggest that, in case that the statistics yield conflicting results, the maximum eigenvalue test may be better.
[5] In fact, we have tested different periods and ML condition begins to be satisfied after 1994.

coefficients are significant indicating that, during floating exchange rate periods, TB is more influenced by foreign and domestic income and, therefore, by foreign and domestic output growth rythms. From our point of view, these results are suggesting that currency devaluation in 2002 was necessary to improve the TB and recover an economic growth path more consistent with the balance of payments constraint that the Argentine economy seems to bear in the long-run (López and Cruz (2000) and Perraton (2003). Finally, we note that the significance of the parameter λ in all samples indicates that trade balance changes does not even up changes in past disequilibrium of either national and foreign income or real exchange rate during the same period.

In addition, by employing error-correction modelling techniques we analyze the short-run impact of a RER depreciation on the trade balance.We have checked that in all periods the estimated VEC models with one cointegrating relations are stable[6] and that the innovations are contemporaneously uncorrelated. This enables us to analyze the J-curve phenomenon for Argentina by taking into account the dynamic lag structure of the VEC formulation. For it, we use the full information estimates from Johansen's correction model and a one time shock to the real exchange rate is traced and the generalized impulse response function of $\ln TB$ are obtained for Cholesky one standard-deviation $\ln RER$ innovations. The results over the hold period are represented in Figure 1[7] and suggest that for Argentina we do not find a negative effect of currency devaluation on the trade balance and the most important improvements on the TB have around four to five years of duration and even holds relatively high for a long period after. However, for the period 1962-1990, Figure 2 shows that the effect is initially positive and becomes negative firstly from the fourth to the sixth year and again from the ninth to the eleventh year. We note that is precisely the unique sample where it is not verified the Marshall-Lerner condition. Hence, no evidence in favour of the J-curve short term TB adjustment was found for Argentina by using annual data for any of the considered periods. Our generalized impulse response function analysis suggests that in the whole period, 1962-2005, a continuous improvement of the trade balance is induced by currency depreciation. In that period ending just before the launching of the Convertibility Plan, we have found a cyclical pattern in terms of the responses of the trade balance to currency devaluation. This cyclical pattern hols over 14-18 years improving first and

[6] The stability of the estimated VAR and VEC has been checked in each of the sub-periods from the inverse kp roots of the characteristic AR polynomial, where k is the number of endogenous variables and p is the largest one. The stability condition is verified if all the roots have modulus less than one. In a VEC estimation with r cointegration relations this implies that kr roots should be equal to unity.

[7] Although, they have not been included in the Appendix, we note that the impulse response functions for the sub-periods 1962-2000 and 1978-2005 show a similar behaviour.

deteriorating later three times in this long period. After 18 years, the cycle ends and RER becomes neutral or slightly negative suggesting a new short-run pattern of J-curve. This phenomenon can be named *cyclical converse* S-curve pattern, contrary to that proposed by Backus et al. (1994) and similar to the converse J-curve effect (Boyd et al. 2001). In this fashion, we highlight that our results present an intense *cyclical pattern* in the flexible exchange rate period not usual in the literature (for similar results see, for instance, Narayan (2006) for New Zealand and the study by Bahmani-Oskooee and Wang (2006) for China and her major trading partners.)

All the reported results on the trade balance dynamic are suggesting the key role of the management and impact of RER. But how much of the variability of the trade balance can be explained by RER shocks and which proportion should be attributed to the income variables? Taking into account the whole time path dynamic of the trade balance described in estimating (7) and for each random innovation in affecting the variables in the VEC modelling, a variance decomposition analysis enables us to identify the importance of exchange rate innovations on the trade balance behaviour.

Table 5 shows for each sample the variance decomposition of the trade balance percentage of the forecast error-variance due to each innovation at different moments in a ten-step ahead analysis Based on the Cholesky factorization, standard errors are generated using Monte Carlo simulation method with 1000 replications. In all periods, it appears that RER plays a major role in determining the Argentine trade balance. We remark that in those long periods including the fix exchange rate policy making, the percentages that RER shocks innovations represent in the variance of TB are around ten percent for the one-year-ahead period but increase up to thirty percent at the ten-year horizon. The proportion of variability that can be attributed to RER impacts is even greater for that sub-period finishing in 2000, when Argentina began its drastic slowdown triggering the sharp crisis in 2002; in this case, and for the same forecast horizons, the variance of TB due to RER moves from around 18% to nearly 37%. In these periods, domestic income is the second main variable to explain the variability of TB. For instance, in 1962-2000, variance of TB due to domestic income goes from 13% to 28% and from 8% to 18% in the whole sample, 1962-2005. However, once we move to the floating regime before the launching of the Convertibility Plan, we observe that RER and US income share the major proportion of variability of TB for the first five-year-ahead forecast and from the six year horizons respectively. We highlight that the variance decomposition result for the sample 1962-1990 is consistent with the high significance exhibited by income time series in the trade balance cointegrating equation and by the fact that ML condition does not hold in this period.

Drawing to a close, we should remark that in this paper, and in step with Argentine real exchange policy-making events, the whole sample period has been exogenously sundered in three sub-periods. Nevertheless, it is well known that the existence of a long-run equilibrium relationship does not always result in stable coefficients. In our case, we note that it is clear that parameter stability must be tested as long as the volatility of the coefficients is extremely high, outstandingly in the case of income variables in those periods considering a fix exchange regime. To conclude, we checked the stability of both the long-run and the short-run parameters by applying the CUSUM and CUSUM of Squares Tests (CUSUMQ) proposed by Brown et al. (1975) to the residuals of the equation (7) across each of the sub-samples. CUSUM and CUSUMQ are based on accumulative recursive residuals and represent its cumulative sum and its cumulative sum of squares against all subsample points respectively. Table (6) summarizes the results for both tests and Figure 3 displays for each of the considered periods the test statistic representation together with the 5% critical values. Concentrating on the plots, we observe that, in the majority of cases, the null hypothesis of parameter constancy cannot be rejected as long as both CUSUM and CUSUMQ statistics fall inside the area between the two critical lines. Only, the movement of the CUSUMQ test in 1978-2005 outside the 5 percent significance bounds is suggestive of parameter instability. To sum up, in each of the considered periods there is evidence of stability in both the long-run and the short-run coefficients.

IV. Conclusions and policy implications

In this paper we assess the long and short-run effects of real exchange rate on the Argentinean TB in a long period beginning in 1962. By using VAR-based cointegration tests and impulse response functions, we show that ML condition is fulfilled in the periods including fix exchange rate regime policy but not in those when exchange rate has shown more flexible policies. This result holds even though there have been episodes of RER overvaluation with relatively flexible exchange rate periods in the Argentine economy as have shown Richaud et al. (2003). Our results coincide with those reported by Mahmud et al. (2004) for developed countries where ML condition is more probably to be fulfilled when fixed exchange rate policies are implemented than in flexible currencies periods.

In the short run, Argentine TB has not usually followed the J-curve pattern of adjustment. RER depreciation had shown permanent improvements on TB when the currency board in the Convertibility Plan is included in the analysed sample. Only before the Convertibility Plan launching in 1991, the impact of RER is negative on the long-term TB adjustment showing that the ML condition does not hold. In this period, we observe the *cyclical converse* S-curve pattern contrary to that proposed by Backus et al. (1994) during the first 14-18 periods. After that, real depreciation effects on TB disappeared suggesting that, in the very long-run, RER has no effects on TB when flexible exchange rate policies are adopted.

The variability of TB is highly due to RER and domestic income whenever the estimation is including the long fixed nominal exchange rate period after 1991. On the contrary, with flexible exchange rates before 1991, foreign income, proxied by US income, turns into the most important variable to explain TB variability. These variance decomposition results enable us to conclude that during the fixed exchange rate period, RER was the key variable to recover TB equilibrium. Because of its fixed parity with US dollar, domestic income was limited to growth if the TB wanted to be re-equilibrated; in any other case the currency board had to be abandoned.

Though all these findings are in line with other country studies, we remark that our analysis over different periods together with variance decomposition clearly improves dynamic previous results in the single country empirical literature on the TB effects of currency depreciation.

To sum up, in the results of these analysis for Argentina we find a strong policy-making implication: currency devaluation in 2002 (and, therefore, the abandon of the currency board implemented in the Convertibility Plan) was necessary for improving TB and recovering a more sustainable economic growth path according with long term balance of payments equilibrium. In this sense, flexible exchange rate policies seems to be necessary to induce a balance of payments long-run sustainability and, therefore, for Argentine economic development.

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APPENDIX

Table 1 . Augmented Dickey-Fuller test (ADF). Argentina 1962-2005.

$$H_0 : \delta = 0$$
$$H_1 : \delta < 0$$

(i) $\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{i=1}^{m} (\alpha_i \Delta y_{t-i}) + \varepsilon_t$

(ii) $\Delta y_t = \beta_1 + \delta y_{t-1} + \sum_{i=1}^{m} (\alpha_i \Delta y_{t-i}) + \varepsilon_t$

(iii) $\Delta y_t = \delta y_{t-1} + \sum_{i=1}^{m} (\alpha_i \Delta y_{t-i}) + \varepsilon_t$

variable	**k**	**Model (i)** Φ_3	**Model (i)** t_{tc}	**Model (ii)** Φ_1	**Model (ii)** t_c	**Model (iii)** t_{nc}
$\ln TB$	0	0.171	-3.428	2.128	-3.49	-2.697***
$\Delta \ln TB$	0	n.a.	n.a	n.a	n.a.	-5.889***
$\ln Y$	1	2.079	- 2.355	1.2366	-1.101	2.039
$\Delta \ln Y$	1	n.a.	n.a	n.a	n.a.	-4.069*
$\ln Y^*$	0	3.59	-3.729	2.767	-1.662	10.256
$\Delta \ln Y^*$	0	n.a.	n.a	n.a	n.a.	-2.144*
$\ln RER$	0	-0.094	-2.791	2.007	-2.851	-1.960
$\Delta \ln RER$	0	n.a.	n.a	n.a	n.a.	-6.875* **

Notes: *k is the* lag structure order chosen to guarantee white noise residuals and Δ is the first differenced lag operator*;* subscripts *tc*, *c* and *nc* indicate if trend and intercept, intercept or none is included in test equation (iii), (ii) and (i). Φ_3, $\tau_{\beta\delta}$, Φ_1, $\tau_{\alpha\mu}$ denote statistics for individual or joint significance of trend and intercept assuming unit root. * and ** show 5% and 1% significance level in accordance to MacKinnon critical values; n.a is non available. Results implemented using Eviews 4.1.

Table 2. VAR. Lags structure and residuals

Period	Lag structure: Lag order	Lag structure: Stability	Ho: non autocorrelation Q	Ho: non autocorrelation LM	Ho: normality JB_{Chol}	Ho: normality JB_{Urz}	Ho: homocedasticity White
1962-2005	1	yes	215.25	13.51	9.07	62.78	89.95
1962-2000	1	yes	185.77	11.82	7.91	61.14	88.13
1978-2005	2	yes	102.12	11.59	12.34	33.51	164.36
1962-1990	2	yes	93.76	9.16	10.62	41.66	170.83

Notes: Lags for autocorrelation tests are taken as the third part of the observations . Results carried out by Eviews 4.1

Table 3. Johansen and Juselius Cointegration Test

Period	Lags	Number of cointegration relations under Ho	λ_{trace}	CV(5%)	λ_{max}	CV(5%)
			Johansen Test			
			Statistics			
1962-2005	1	r=0	49.38*	47.21	32.04*	27.07
		r=1	17.34	29.68	10.38	20.97
		r=2	6.95	15.41	6.84	14.07
		r=3	0.12	3.76	0.12	3.76
1962-2000	1	r=0	55.12*	47.21	32.23*	27,07
		r=1	22.88	29.68	14.89	20.97
		r=2	7.98	15.41	7.89	14.07
		r=3	0.09	3.76	0.09	3.76
1978-2005	2	r=0	63.22**	47.21	33.32**	27.07
		r=1	29.91*	29.68	16.43	20.97
		r=2	13.47	15.41	12.81	14.07
		r=3	0.66	3.76	0.66	3.76
1962-1990	2	r=0	85.71**	47.21	56.52**	27.07
		r=1	29.19	29.68	16.26	20.97
		r=2	12.92	15.41	12.89	14.07
		r=3	0.03	3.76	0.03	3.76

Notes: Lag structure is drawn in each period from Table 3 results. *(**) denotes rejection of the hypothesis at the 5%(1%) level taking into account Osterwald-Lenum critical values. Trace and Max-eigenvalue test indicates 1 cointegrating equation(s) both 5% level. Results computed with Eviews 4.1

Table 4 . Johansen. Estimated cointegrating equation

Period	b_0	b_1	b_2	b_3	ECM λ
	Cointegrating coefficients				
1962-2005	0.1591	-0.3395	0.3339	0.6095	- 0.8837
		[0.8281]	[-1.362]	[-5.51]	[-4.483]
1962-2000	1.423	- 0.6121	0.3295	0.3887	-0.692
		[1.541]	[-1.323]	[-3.336]	[-3.98]
1978-2005	0.0128	-0.115	0.124	0.8231	-1.943
		[0.323]	[-0.769]	[-10.887]	[-3.683]
1962-1990	-0.512	- 0.8296	1.1224	- 0.0283	-3.022
		[9.454]	[-15.149]	[0.863]	[-7.956]

Notes: The vectors are normalized for TB; b_1, b_2 and b_3 denote the argentine GDP, USA GDP and RER elasticities of trade balance, respectively. Figures in parentheses represent asymptotic *p*-values associated with the tests. Results carried out by Eviews 4.1.

Table 5. Trade Balance Variance decomposition

Period		Ahead forecast horizon 1	3	5	6	7	8	9	10
1962-2005	S.E.	0.365	0.491	0.567	0.606	0.642	0.675	0.706	0.736
	$\ln Y$	8.589	15.168	15.990	16.515	16.960	17.275	17.514	17.720
	$\ln Y*$	0.057	4.863	7.030	7.318	7.666	8.017	8.294	8.503
	$\ln RER$	12.337	27.385	27.637	28.040	28.566	28.933	29.166	29.355
1962-2000	S .E.	0.322	0.414	0.454	0.474	0.495	0.514	0.533	0.551
	$\ln Y$	12.745	21.587	24.297	25.385	26.327	27.139	27.840	28.450
	$\ln Y*$	0.763	1.736	3.878	4.358	4.693	4.979	5.242	5.481
	$\ln RER$	18.598	32.838	34.215	34.795	35.407	35.975	36.466	36.885
1978-2005	S.E.	0.408	0.545	0.627	0.668	0.709	0.754	0.794	0.824
	$\ln Y$	4.126	6.751	11.665	12.028	11.617	11.124	11.116	11.663
	$\ln Y*$	0.272	4.597	7.230	6.681	6.381	6.842	7.702	8.118
	$\ln RER$	7.134	27.861	26.140	23.823	24.069	26.940	29.029	28.997
1962-1990	S.E.	0.323	0.369	0.427	0.446	0.448	0.452	0.459	0.472
	$\ln Y$	6.555	10.930	10.815	9.970	9.905	10.046	10.589	10.349
	$\ln Y*$	24.399	24.777	26.970	30.762	30.465	31.299	30.374	31.149
	$\ln RER$	41.698	34.405	29.365	27.399	27.884	27.385	27.387	26.055

Notes: S.E indicates the forecast error of the variable at the given forecast horizon.Cholesky Ordering: $\ln TB, \ln Y, \ln Y^*, \ln RER$. Results carried out with Eviews 4.1.

Table 6. CUSUM and CUSUMQ tests. Stability results

Period	CUSUM	CUSUMQ
1962-2005	Stable	Stable
1962-2000	Stable	Stable
1978-2005	Stable	Unstable
1962-1990	Stable	Stable

Figure 1. Trade response to a RER shock.1962-2005

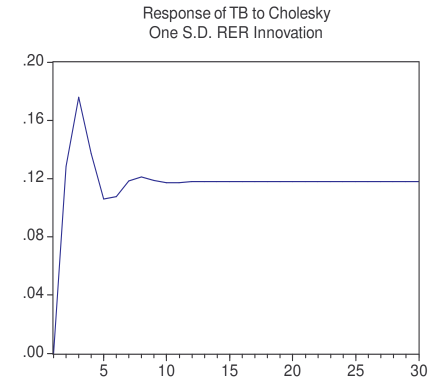

Figure 2.Trade response to a RER shock.1962-1990

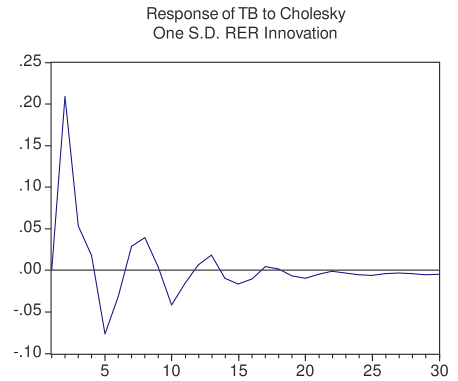

Figure 3. Plots of Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUM of Squares)

Figure 3.1. 1962-2005

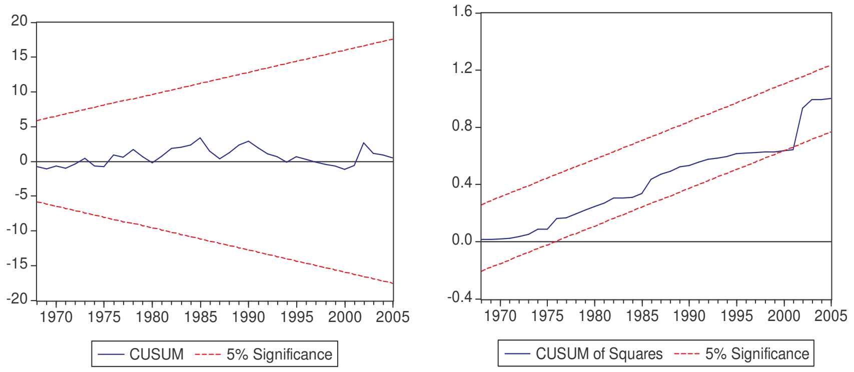

Figure 3.2. 1962-2000

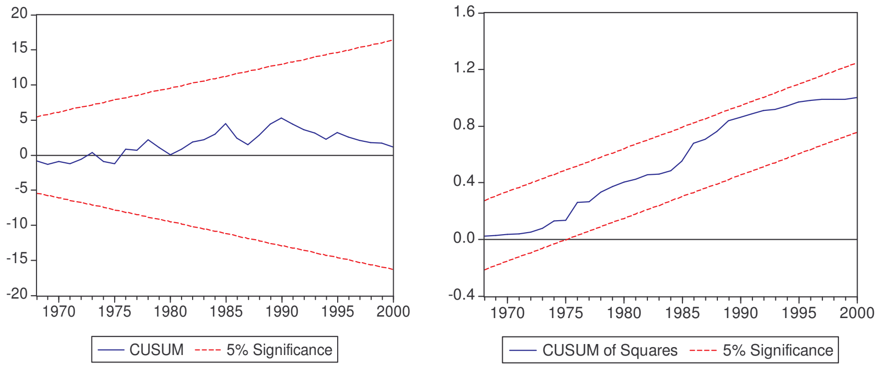

Figure 3.3. 1978-2005

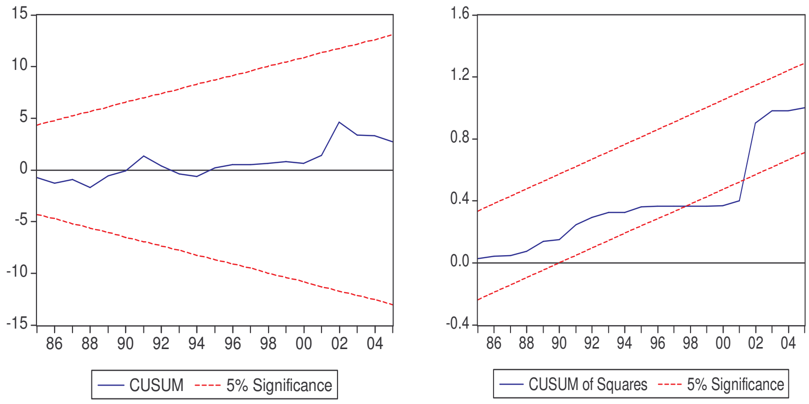

Figure 3.4. 1962-1990